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(54) Improvements relating to synthetic plastic beakers

(57) A beaker made of synthetic resin has a downwardly enlarged foot (20) and comprises a synthetic resin foil (10) which is deep drawn by means of a pressure medium or vacuum. The beaker is preferably produced by a method which involves heating a synthetic resin foil (10) and pressing it by means of a plunger (60) into a female mould (48) which has an undercut for the beaker foot. Thereafter the deep drawing operation is performed whereupon the portions of the wall of the female mould providing the undercut are withdrawn from the beaker. Also poroposed is a deep-drawing tool comprising a female mould (48), the wall of which is formed by at least two tool members (40) which are disposed opposite each other and displaceable away from each other.

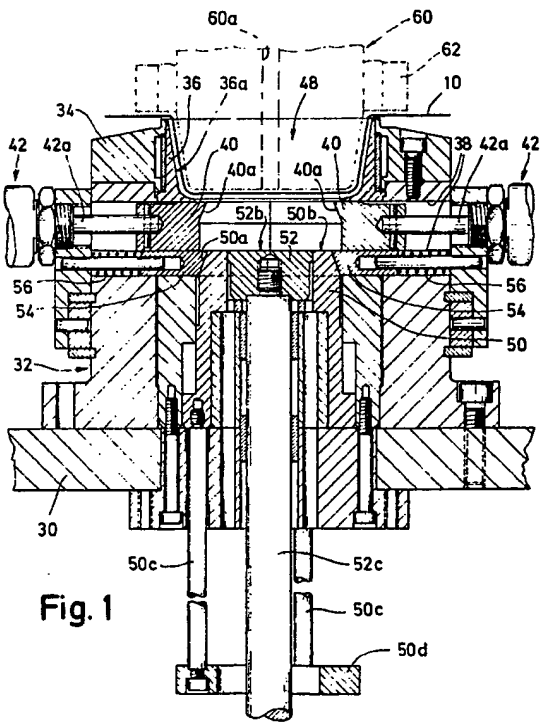

Fig. 1

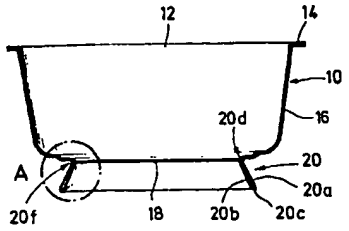

Fig. 5

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

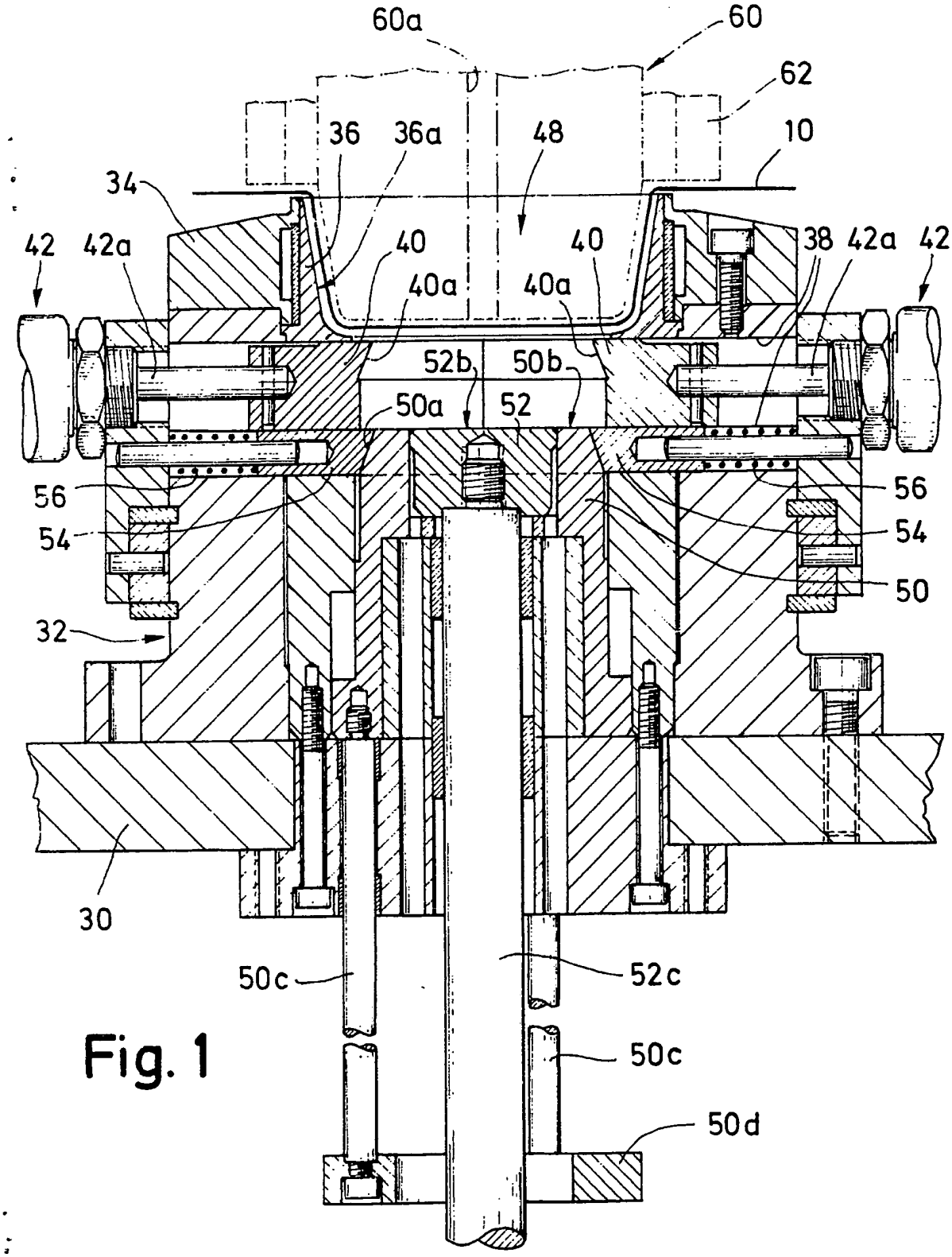
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Fig. 1

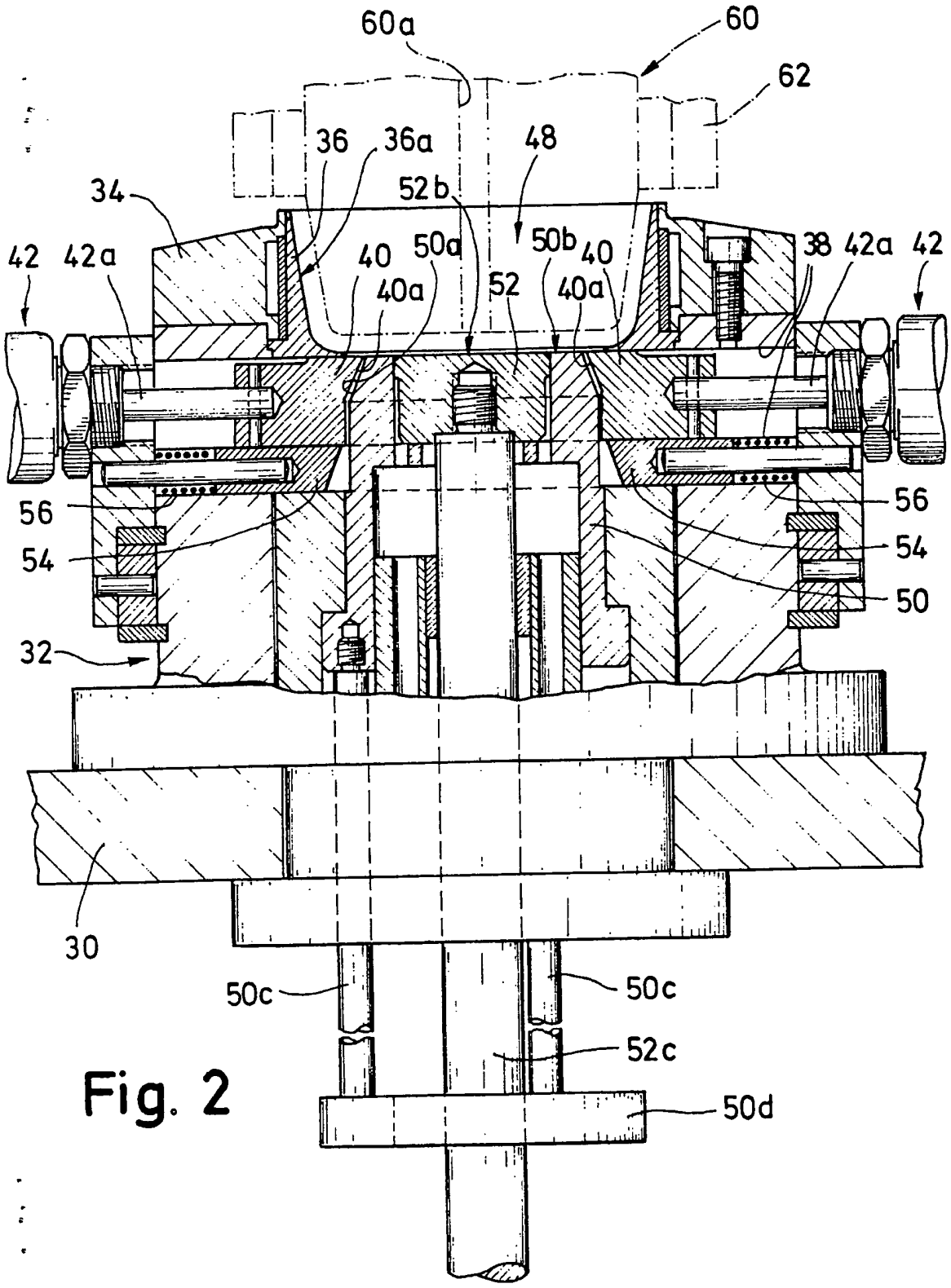
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Fig. 2

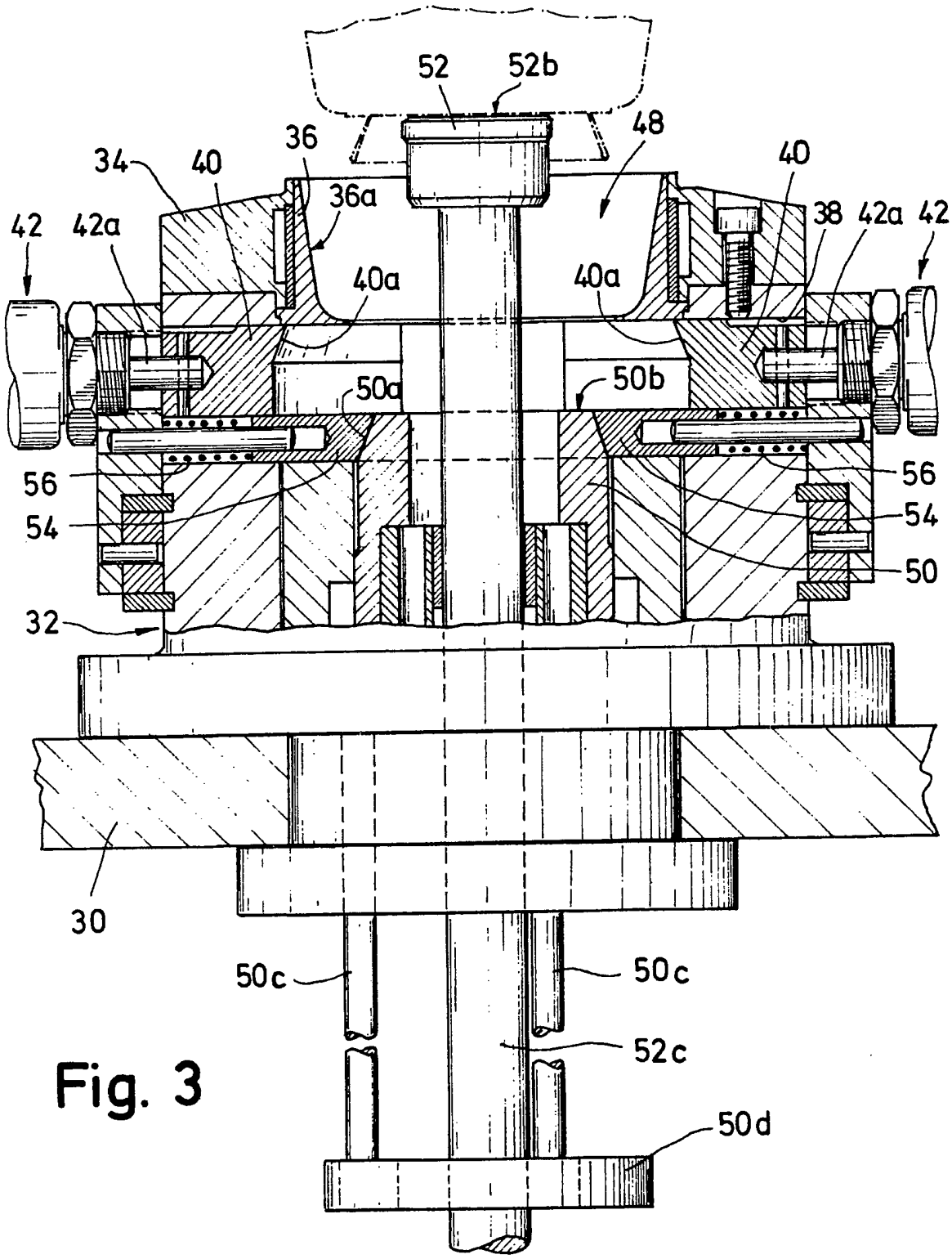
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Fig. 3

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Fig. 4

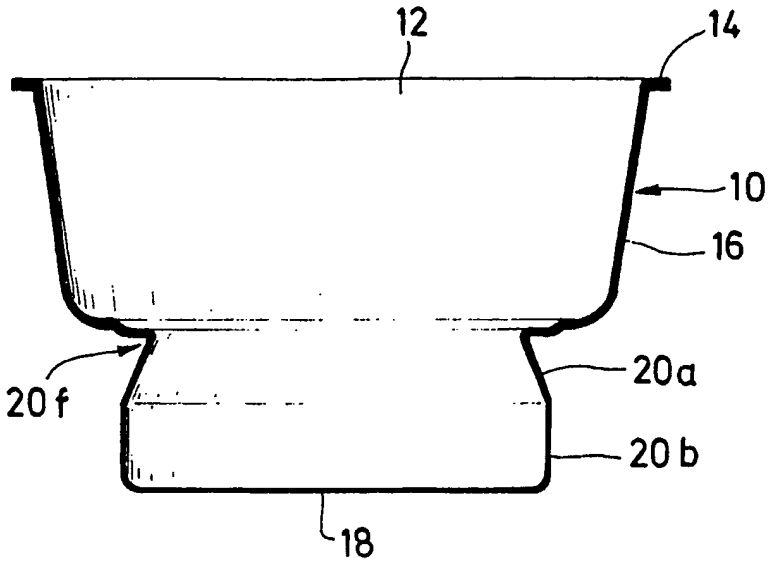


Fig. 5

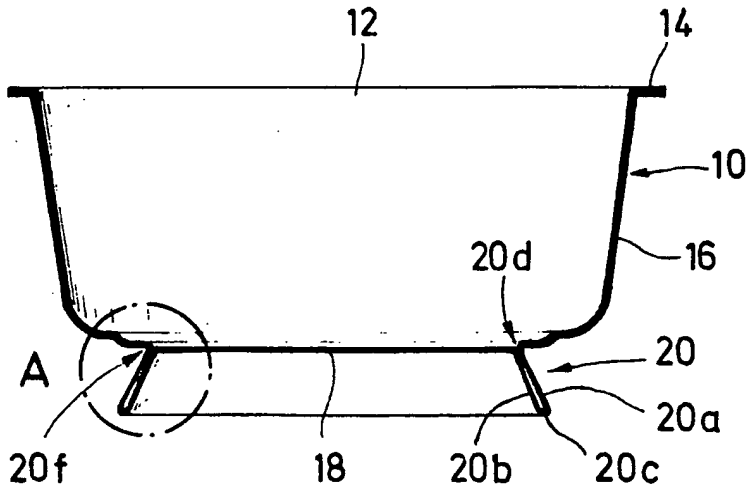
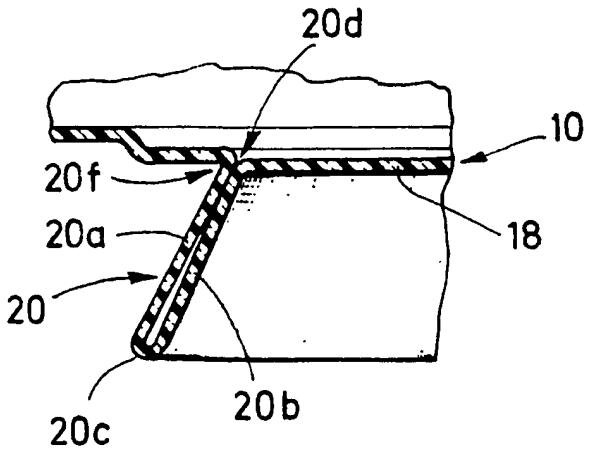


Fig. 6



SPECIFICATION

Improvements relating to synthetic plastic beakers

The invention relates to a beaker of synthetic resin having a downwardly enlarging foot, such as used frequently in particular by the milk processing industry and the food canning industry.

Heretofore such beakers of synthetic resin which by the way are usually of rotation-symmetrical construction so that the foot is in the form of a truncated cone, were produced exclusively by an extrusion moulding method, the foot being constructed as a rail of solid material which extends downwardly from the beaker bottom and forms a cone. As a rule these beakers of synthetic resin are imprinted in order to permit them to be decorated in colours.

The invention was based on the problem to provide a beaker of synthetic resin which can be produced more economically than the extrusion-moulded beakers described. As a solution a beaker of synthetic resin is proposed which consists of a synthetic resin foil which is deep-drawn by means of a pressure medium or vacuum. For the deformation of the synthetic resin foil by means of a pressure medium and/or a vacuum undercuts of a moulding tool, such as necessary for the production of a downwardly enlarging foot, do not play such an important role as is the case for deep-drawing by means of a mould plunger of normal articles without undercuts. Compared with the extrusion-moulded synthetic resin beakers, the beaker according to the invention has the advantage that it can be produced with less expenditure of material, and since, moreover, synthetic resin foils may be produced without difficulties in which the two foil sides are formed by different materials, the beaker according to the invention may even be produced without difficulties in e.g. a constructional form the outside of which possesses a different colour than the inside of the beaker.

It may be envisaged per se that the interior of the beaker extends downwardly as far as the lower end of the beaker foot; however, when the beaker bottom is to be arranged above the lower end of the foot which is hollow below the beaker bottom, the foot of the synthetic resin beaker according to the invention is double-walled between its lower end and the beaker bottom; just in the case of a foil beaker this imports also the advantage of increased stiffness of the beaker foot. In order to avoid in this case penetration of the beaker contents into the double-walled foot, in a preferred constructional form of the foil beaker according to the invention the inner wall of the foot is connected, in particular welded, to the outer wall thereof approximately at the level of the bottom of the beaker.

Most advantageously the foil beaker according to the invention is so produced that a synthetic resin foil is heated, then pressed by means of a plunger into a female mould which comprises an undercut for the foot of the beaker, and subsequently is completely formed in this female mould by means of a pressure medium and/or a vacuum, whereupon the portions of the wall of the mould which form the undercut are withdrawn from the beaker. When in this context reference is made to a hollow body this is to means merely that a region of the synthetic resin foil is converted to a vessel-like shape.

Obviously a plurality of adjacently and/or successively disposed regions of the synthetic resin foil may be deep-drawn at the same time, this being a particular advantage for the production of beakers according to the invention.

It is advisable for the production of the preferred constructional form of the beaker according to the invention that after the formation of the hollow body the beaker bottom is pressed upwardly - in this case upwardly is al ays to signify in the direction of the beaker opening. According to a further feature of the invention, the inner wall and the outer wall of the foot of the beaker are welded together in that ring-shaped wall regions of the walls of the beaker foot are pressed against each other while the beaker bottom is being pressed upwardly, as long as the foil possesses sufficiently high temperatures.

Finally it is proposed to construct a deep-drawing tool for the production of the foil beaker according to the invention in such a manner that a female mould comprising an undercut for the foot of the beaker is provided the wall of which is formed at least in the region of the undercut by at least two tool members which are located opposite each other and which may be displaced away from each other. Therefore the deep-drawing tool according to the invention need not be divided altogether along a centre plane in order to permit the foil beaker to be ejected; for this reason it is relatively simple to arrange a plurality of female moulds adjacently and/or successively at small spacings.

In order to obtain a hollow beaker foot and to weld the outer wall of the foot to the inner wall of the foot, it is advisable to construct the deep-drawing tool in such a manner that the bottom of the female mould is formed by an upwardly displaceable mould plunger the upper end face of which corresponds to the cross-section of the beaker at or slightly below the location at which the inner space of the beaker has its smallest cross-section. When the inner wall of the beaker foot and the outer wall of the beaker foot are to extend parallel to each other substantially without spacing, the deep-drawing tool according to the invention is constructed in such a manner that the mould plunger tapers upwardly corresponding to the shape of the beaker foot and that its upper end face is flush with the surfaces facing the beaker of tool members which may be displaced away from each other transversely to the direction of movement of the mould plunger and which embrace tightly the upper end face of the mould plunger when the mould plunger is retracted. These tool members prevent the synthetic resin foil being drawn down under the upper end face of the mould plunger by the applied pressure and/or an applied vacuum. Conveniently they are resiliently biassed, so that they can escape when the mould plunger is advanced for the purpose of pressing the beaker bottom upwards.

Further features, advantages and details of the

invention will be clear from the accompanying claims and/or from the following description as well as the accompanying pictorial representation of preferred constructional forms of the container of synthetic resin foil according to the invention and the deep-drawing tool for its production; there are shown in:

Figure 1 a longitudinal section through the deep-drawing tool in a state which occurs after the pre-heated synthetic resin foil has been pressed into the female mould by a preforming plunger illustrated by broken lines;

Figure 2 the same section as in Figure 1, but after the mould plunger has been displaced upwards which presses the beaker bottom upwards;

Figure 3 again the same section, but after the ejection of the beaker of synthetic resin foil;

Figure 4 a longitudinal section through the beaker of synthetic resin foil according to the invention after deep-drawing, put prior to upward displacement of the beaker bottom;

Figure 5 a longitudinal section through the finished beaker, and

Figure 6 the section A indicated in Figure 5, in an enlarged illustration.

First the preferred constructional form of the beaker of synthetic resin foil according to the invention is to be explained in detail with reference to Figures 5 and 6.

This beaker consists of a synthetic resin foil 10 which for example is coloured differently on the outside than on the inside, and it comprises an edge flange 14 surrounding an opening 12 for sealing thereto a closure foil or the like, a beaker wall 16, a beaker bottom 18 and a foot reference generally by 20. Obviously, in place of the edge flange 14 any other edge configuration may be provided, e.g. an inverted U-shaped edge form of clip-on lid.

As may be seen best from Figure 6, the foot 20 is double-walled, that is to say it is constructed from an outer wall 20a and an inner wall 20b which are in mutual connection at two locations, namely at a fold location 20c forming the lower edge of the foot 20, and at a weld 20d at the transit of the beaker bottom 18.

The foot 20 has the configuration of a truncated cone and forms an undercut 20f.

The deep-drawing tool illustrated in Figures 1-3 constitutes a section from a total tool which comprises a plurality of female moulds, by means of which simultaneously a plurality of beakers according to the invention may be deep-drawn from a pre-heated web of synthetic resin foil; however, for reasons of simplicity merely the tool portion has been illustrated which forms a single female mould, and even this one only partially since devices for preforming a heated synthetic resin foil as well as for applying a pressure or underpressure have only bee indicated.

A support plate 30 has fastened thereto a tool block which is denoted generally by 32 and on which a die box 34 and within the latter a mould ring 36 are mounted. Below the latter two slider members 40 are displaceably guided between mutually parallel guide faces 38 and form two mutually abutting semi-circular foot forming walls 40a and may be withdrawn from each other to the right and to the left in a radial direction and removed from each other by means of pressure medium cylinders 42 by way of piston rods 42a. Thus the inner surface 36a of the mould ring 36 and the foot forming walls 40a form a female mould 48. This is limited downwardly by a bottom mould plunger 50, an ejector ram 52 which is vertically displaceable in the latter, and four closure slider members 54 which latter may be displaced in a star-shaped manner outwardly and perpendicularly to the vertically extending centre axis of the tool in opposition to the effect of return springs 56 and which are placed tightly against a conical surface 50a of the bottom mould plunger 50 under the effect of the return springs, together embrace the said mould plunger in a ring-like manner and are flush with the upper end face 50b thereof as well as the upper end face 52b of the ejector ram 52.

It must still be stated that the ejector ram 52 may be actuated by a rod 52c, the bottom mould plunger 50 may be actuated by rods 50c and a ring 50d connecting together the latter.

Above the female mould 48, a pre-forming plunger 60 is provided which comprises a central compressed air duct 60a. It is surrounded by a depresser and cutter ring 62 which co-operates during depressing with the upper outer ring edge of the die box 34 in the manner of a punching tool.

For the production according to the invention of the novel beakers of synthetic resin foil it is best to follow the following procedure:

First a pre-heated synthetic resin foil 10 is inserted between the pre-forming plunger raised relatively to the position thereof illustrated in Figure 1 and the members 34 and 36 of the deep-drawing tool according to the invention, whereupon the pre-forming plunger is lowered approximately to the position illustrated by dash-dotted lines in Figures 1 and 2. The foil beaker to be produced has a wall thickness which is the more uniform the deeper the foil is drawn into the female mould by the pre-forming plunger. In this case the synthetic resin foil may be clamped between the depresser ring 62 and the die box 34.

Subsequently the upper surface of the foil 10 is subjected to pressure - for this purpose the portion of the deep-drawing tool which lies above the foil 10 in the region of the female mould 48 must obviously form a closed pressure space; this, however, has not been illustrated in the drawing, since this is an obvious fact for the expert. By this pressure (in its place alternatively a vacuum applied to the underside of the foil may be employed; this, however, would be less advantageous because of the lower deforming forces) the foil is pressed downwardly over the upper inner ring edges of the slider members 40 and below these ring edges also outwardly in a radial direction, so that the intermediate product illustrated in Figure 4 is obtained. In this case the closure slider members 54 prevent the foil being pressed into the annular gap between the lower inner edge of the slider members 40 and the upper outer edge of the bottom mould plunger 50; this only renders it possible to permit the latter to taper upwardly.

Thereafter the bottom mould plunger 50 and the ejector ram 52 are displaced synchronously to the position illustrated in Figure 2, whereby the beaker bottom 18 is pressed upwards and the foil regions which are still sufficiently hot are welded together at 20d, since the outer circumference of the upper end face 50b of the bottom mould plunger 50 is smaller by less than twice the foil thickness than the diameter of the clear upper opening which is formed by the two slider members 40 moved one against the other. When the bottom mould plunger 50 is displaced from its position illustrated in Figure 1 towards the top, its conical surface 50a presses the closure slider members 54 outwardly back in a radial direction, as illustrated in Figure 2.

It is a particular feature of the tool according to the invention that the upper region of the bottom mould plunger 50 possesses approximately the same conicity as, or a merely slightly smaller conicity than, the foot forming walls 40a of the slider members 40 which mould the outside of the foot of the beaker. It is attained thereby that the inner wall 20b of the foot of the beaker extends at least approximately parallel to the outer wall 20a of the foot and preferably lies against the same, whereby the stability of the beaker foot is increased considerably.

Subsequently the foil beaker is punched out by means of the cutter ring 62, whereupon the cutter ring and the pre-forming plunger 60 are displaced upwardly, the slider members 40 are displaced outwardly by means of the pressure medium cylinders 42 and the ejector ram 52 is displaced upwardly in order to eject the finished beaker, such as illustrated in Figure 3.

Although the production of a rotation-symmetrical beaker was explained with reference to the drawing, obviously beakers may also be produced by means of the method according to the invention and the deep-drawing tool according to the invention which for example are elliptical, triangular or rectangular in horizontal section planes.

CLAIMS

1. A beaker of synthetic resin having a downwardly enlarged foot, and comprising a synthetic resin foil which is deep-drawn by means of a pressure medium or vacuum.

2. A beaker according to claim 1, wherein the floor of the beaker is above the bottom of the foot which is hollow below the beaker floor, characterised in that the foot is double-walled between its bottom and the beaker floor.

3. A beaker according to claim 2, wherein the inner wall and the outer wall of the foot are connected together, at least at the approximate level of the beaker floor.

4. A beaker according to one or more of the preceding claims, wherein the inside and the outside of the synthetic resin foil are of different material.

5. A method of producing a beaker according to any of the preceding claims, wherein a synthetic resin foil is heated, then pressed by means of a plunger into a female mould which comprises an undercut for the beaker foot, and is subsequently completely formed in this female mould by means of a pressure medium and/or a vacuum, whereupon the portions of the wall of the female mould providing the undercut are withdrawn from the beaker.

6. A method according to claim 5, wherein the beaker bottom is pressed upwards after the formation of the hollow body.

7. A deep-drawing tool for performing the method according to claim 5 or claim 6, and comprising a female mould with an undercut for the beaker foot, the wall of the mould at least in the region of the undercut being formed by at least two tool members which are disposed opposite each other and displaceable away from each other.

8. A tool according to claim 7, wherein the bottom of the female mould is formed by an upwardly displaceable mould plunger of which the upper end face corresponds to the cross-section of the beaker at or slightly below the location at which the interior space of the beaker has its smallest cross-section.

9. A tool according to claim 8, wherein the mould plunger tapers upwardly corresponding to the shape of the beaker foot and has its upper end face flush with the surfaces facing the beaker of tool members which are displaceable away from each other transversely to the direction of movement of the mould plunger and which embrace the upper end face of the mould plunger tightly when the mould plunger is retracted.

10. A tool according to claim 8, wherein the upper end face of the retracted mould plunger is located below the location of the wall of the female mould, which location corresponds to the lower end of the beaker foot.

11. A tool according to claim 9, wherein the tool members which embrace the mould plunger are resiliently biased in the direction of the mould plunger.

12. A tool according to claim 7, wherein the tool members which form the undercut are constructed in the form of slider members provided with driving means.

13. A tool according to any of claims 8 to 12, and characterised by a longitudinally displaceable ejector located in the mould plunger.

14. A beaker of synthetic resin constructed and produced substantially as hereinbefore described with reference to the accompanying drawings.

15. A method of producing a beaker of synthetic resin as claimed in any of claims 1 to 4 substantially as hereinbefore described.

16. A deep drawing tool for performing the method claimed in any of claims 5, 6 and 15.

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